CLAIMS

1. A channel simulation method to simulate transmission on MxN channels formed by M transmission antennas and N reception antennas, comprising:

a channel variation forming step of forming a channel variation on each of the MxN channels using information of arrangements of transmission and reception antennas; and

a channel variation adding step of adding channel variations corresponding to the MxN channels to respective signals of the MxN channels.

2. The channel simulation method according to claim 1, wherein in the channel variation forming step, a delay and a phase variation on each of the channels due to the arrangements of antennas are obtained using the information of arrangements of transmission and reception antennas, and channel variations are formed such that the delay and the phase variation vary with the channels.

3. The channel simulation method according to claim 2, wherein in the channel variation forming step, in forming a short-term variation on each of the channels as the channel variation, short-term variations corresponding to the MxN channels are formed by obtaining a difference in path distance between each path of a reference channel beforehand set or prepared and pertinent each path of each of the channels using the information of a positional relationship between

transmission and reception antennas on each of the channels and information of a radiation direction and a direction of arrival on each path, and for a signal of pertinent each path of each channel, generating a short-term variation such that a phase difference occurs with respect to a short-term variation of each path of the reference channel by the difference in path distance.

4. The channel simulation method according to claim 1, wherein in the channel variation forming step, in forming an instantaneous variation on each of the channels as the channel variation, correlated instantaneous variations corresponding to the MxN channels are formed by repeating processing, the number of times corresponding to the MxN channels, for generating respective band-limited gaussian noises corresponding to the reference channel and another channel, subjecting two band-limited gaussian noises to weighted addition with correlated filter characteristics using at least the information of arrangements of antennas as a parameter, and thereby forming a correlated instantaneous variation correlated with an instantaneous variation on the reference channel.

5. The channel simulation method according to claim 1, wherein the channel variation forming step includes the steps of:

generating MxNx(the number of paths) instantaneous variations mutually independent between the channels;

obtaining an (MNxMN) correlation matrix from a difference in propagation path distance of each path obtained from input data or experiment data and a positional relationship of antennas, and theoretical spatio correlation values of Rayleigh fading;

obtaining based on the correlation matrix a transformation matrix to calculate mutually correlated signal vectors from signal vectors that are not correlated with one another; and

obtaining MxNx(the number of paths) correlated instantaneous variations correlated between channels, by repeating, the number of times corresponding to the number of paths, matrix operation processing using the transformation matrix for each instantaneous variation of a pertinent path of each channel.

6. The channel simulation method according to claim 1, wherein the channel variation forming step includes the steps of:

generating MxNx(the number of paths) instantaneous variations mutually independent between channels and between paths;

obtaining an (MNx(the number of paths)xMNx(the number of paths)) correlation matrix from a difference in propagation path distance of each path obtained from input data or experiment data and a positional relationship of antennas, and theoretical temporal-spatio correlation values of Rayleigh fading;

obtaining based on the correlation matrix a transformation matrix to calculate mutually correlated signal vectors from signal vectors that are not correlated with one another; and

obtaining MxNx(the number of paths) correlated instantaneous variations correlated between paths, by performing matrix operation processing using the transformation matrix on the MxNx(the number of paths) instantaneous variation.

7. The channel simulation method according to claim 5 or 6, wherein in the step of obtaining a transformation matrix, the transformation matrix is obtained by eigenvalue transformation.

8. The channel simulation method according to claim 5 or 6, wherein in the step of obtaining a transformation matrix, the transformation matrix is obtained by Cholesky factorization.

9. A channel simulator that that simulates channel characteristics of a wireless apparatus using an MxN-channel transmission system using M transmission antennas and N reception antennas, comprising:

an input section which inputs M signals obtained by a transmission system of the wireless apparatus;

a signal replicating section which makes N copies of each of the M signals, and thereby forms MxN channel signals;

a channel processor that adds a channel variation

to each of the MxN channel signals corresponding to arrangements of transmission and reception antennas; and

a combiner that selectively combines M channel signals repeatedly among the MxN channel signals each provided with the channel variation to form N signals.

10. The channel simulator according to claim 9, wherein the channel processor has a path former that forms a signal of each path having a delay corresponding to the arrangements of transmission and reception antennas for a signal of each of the channels, a short-term complex impulse response generator that forms a complex gain of a short-term variation to be added to each path of each of the channels, and a short-term variation adder that adds the short-term variation to the signal of each path of the each of the channels, and the short-term complex impulse response generator obtains a difference in path distance between each path of a reference channel and pertinent each path of each of the channels using information of a positional relationship between transmission and reception antennas on each of the channels and a radiation direction and a direction of arrival on each path, and for the signal of each path of each of the channels generated in the path former, generates a short-term variation such that a phase difference occurs with respect to a short-term variation of each path of the reference channel beforehand set or prepared by the difference in path distance.

11. The channel simulator according to claim 9, wherein the channel processor has a path former that forms a signal of each path having a delay corresponding to the arrangements of transmission and reception antennas for a signal of each of the channels, a correlated gaussian noise generator that generates a correlated instantaneous variation to be added to each path of each of the channels, and a correlated instantaneous variation adder that adds the correlated instantaneous variation to the signal of each path of each of the channels.

12. The channel simulator according to claim 11, wherein the correlated gaussian noise generator forms correlated instantaneous variations corresponding to the MxN channels by repeating processing, the number of times corresponding to the MxN channels, for generating respective band-limited gaussian noises corresponding to the reference channel and another channel, subjecting two band-limited gaussian noises to weighted addition with correlated filter characteristics using at least the information of arrangements of antennas as a parameter, and thereby forming a correlated instantaneous variation correlated with an instantaneous variation on the reference channel.

13. The channel simulator according to claim 11, further comprising:

a transformation matrix calculator which obtains a correlation matrix from a difference in propagation

path distance of each path obtained from input data or experiment data and a positional relationship of antennas, and theoretical spatio correlation values of Rayleigh fading, and then, based on the correlation matrix, obtains a transformation matrix to calculate mutually correlated signal vectors from signal vectors that are not correlated with one another,

wherein the correlated gaussian noise generator has:

an instantaneous variation generator that generates MxNx(the number of paths) instantaneous variations mutually independent between channels; and

a matrix operator that generates MxNx(the number of paths) correlated instantaneous variations correlated between channels, by repeating matrix operation processing using the transformation matrix on the instantaneous variations the number of times corresponding to the number of paths.

14. The channel simulator according to claim 11, further comprising:

a transformation matrix calculator which obtains a correlation matrix from a difference in propagation path distance of each path obtained from input data or experiment data and a positional relationship of antennas, and theoretical temporal-spatio correlation values of Rayleigh fading, and then, based on the correlation matrix, obtains a transformation matrix to calculate mutually correlated signal vectors from signal vectors that are

not correlated with one another, wherein the correlated gaussian noise generator has:

an instantaneous variation generator that generates MxNx(the number of paths) instantaneous variations mutually independent between the channels and between the paths; and

a matrix operator that generates MxNx(the number of paths) correlated instantaneous variations correlated between the paths, by performing matrix operation processing using the transformation matrix on the instantaneous variations.

15. The channel simulator according to claim 13 or 14, wherein the transformation matrix calculator obtains a transformation matrix by eigenvalue transformation.

16. The channel simulator according to claim 13 or 14, wherein the transformation matrix calculator obtains a transformation matrix by Cholesky factorization.

17. The channel simulator according to claim 9, further comprising:

an analog adjustor which is comprised of a digital circuit, and simulates fluctuations in a signal of each of the channels caused by fluctuations in performance of an analog circuit corresponding to each of the MxN channels.

18. The channel simulator according to claim 9, further comprising:

an input interface that inputs an output signal of

a digital baseband processor of a transmission system of the wireless apparatus;

a gain controller that performs gain control such that a signal level becomes almost constant of a multipath signal resulting from addition of the signal of each path provided with the channel variation; and

an output interface that outputs the digital baseband signal subjected to the gain control to a digital baseband processor of the reception system of the wireless apparatus,

wherein the channel processor adds a channel variation component with an I component and a Q component equal to each other.